1.1 #1,5,8

Mathematical model

- A function that describes real world events
  - Continuous models
    - Nicely modeled by differential equations
  - Discrete model
    - Iterative equations
  - Scalar models
    - One dependent variable
  - Vector models
    - More than one dependent variable
  - Dynamical model
    - Time dependent

y is proportional to x

$y = kx$

$\frac{dy}{dt} = ky$ — $\frac{dy}{dt}$ is proportional to y

$\frac{dy}{dt} = k \cdot \frac{1}{y}$ — $\frac{dy}{dt}$ is inversly proportional to y

Differential Equations (DE)

- Ordinary differential eq. (ODE) $\frac{dy}{dx} = 5x$
  - only ordinary derivatives
- Partial differential eq. (PDE) $\frac{\partial y}{\partial u} + \frac{\partial y}{\partial v} = 1$
  - contains partial derivatives
- First order D.E
  - Only one derivative
- Higher order D.E $\frac{d^2y}{dx^2} = y + 4$

1.1

Hookes law

$$m\frac{d^2x}{dt} = -kx$$

$$\frac{dx}{dt} = y$$

$$m\frac{dx}{dt} = -kx$$

First order D.E

$$\frac{dy}{dt} = f(y,t)$$

Determine if $y = e^{2t}$ is a solution?

$y' = 2y$

$$\frac{d}{dt}e^{2t} = e^{2t} \cdot 2$$

$$= 2e^{2t}$$

$$y' = 2y$$